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Simulating business and operations management – a learning environment for the electronics industry

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Abstract

The Training Factory for the Electronics Industry has been working since 1999. It is a common project of several companies and educational organizations. It is a kind of network project created in conjunction with the Pro Electronica project of Oulu regional centre excellence programme. The purpose of the project has been to create a learning environment where industrial engineering, operations management of entire production line, logistics and business in the electronics industry can be simulated and learned. The history of business simulations in general is more than 40 years long. Since first introduced the development of simulations has been diverse. The main purpose of business games or simulations is to imitate the real decision making process or environment of business. Although some simulations are better and some worse, the method used in all simulations is a form of experiential learning. In the Institute for Management and Technological Training (POHTO) there is long experience of simulations and the method of learning by doing. Green-PowerTM is the first generation training factory aimed especially at the process industry. Because of the good experience the second generation training factory – OperEx-PowerTM – was constructed to correspond to the specific features of the electronics industry. The main purpose of this article is to present the created participating learning environment in total and describe the managerial functions of OperEx-PowerTM connected to production automation. The second goal is to describe the construction process of the environment, based on the Kolb (1984) theory of experiential learning and using a constructive framework. Conclusions are at the end of the review based on experiences from training events. © 2001 Elsevier Science B.V. All rights reserved.

Keywords: Training factory; Manufacturing; Business simulation; Experiential learning

1. Introduction

The growth and development in the electronics industry has been enormous. The technological development is to a large extent based on magnificent

and innovative research and development. This sets special strategic requirements for resources, where the amount of capable designers is the scarce resource. In proportion this has caused the need for additional training for capable personnel in product development [1,2].

The history of business simulations is more than 40 years long. They were first used in the 1950s in order to intensify the learning experience at the

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university level. About ten years later simulations were also adopted in business [3]. Thereafter the number and usage of simulations has been growing both in academia and in business. The supply of simulations has been diverse from playing cards and board games to computer aided systems. Some of them have concentrated on production technology, machinery and equipments, marketing, selling, production or on general management enhanced with different additional real life tasks. Although some simulations are better and some worse, the method used in all simulations is a form of experiential learning.

Kolb [4] defines learning as the process whereby knowledge is created by the transformation of experience. Business simulations are one form of experiential learning, which often is a very effective way of learning. In many simulations the experience is a dynamic one in which a series of problems are presented or decisions have to be taken [5]. Reflection and evaluation after the simulation experience form an important part of the exercise.

Green-Power™ is the first generation training factory in the Institute for Management and Technological Training in Finland Oulu. It is literally based on learning by doing, because products that are going to be sold have to be actually processed in the factory. It is especially aimed at the process industry and it has been in active use since 1992. Based on years of successful training experience in the process factory the second generation training factory – OperEx-Power™ – was constructed to correspond to the specific features of the electronics industry. OperEx-Power™ contains managerial and operative decision making for research and development, purchasing, sales and order handling, production planning, finance and a real manufacturing surface mounted device (SMD) process.

The main purpose of this article is to present the created participating learning environment in total and describe the managerial functions connected to production automation. The second goal is to describe the construction process of the training factory and OperEx-Power™ system, based on Kolb's [4] theory of experiential learning and using a constructive framework. The conclusions are at the end

of the article based on experience from the early training events.

2. Foundations of contemporary approaches to experiential learning

People learn from their experience. Work/study assignments, structured exercises and role games, simulation and games and other experience-based learning play a larger role in education. Experiential learning is based on traditions of social psychology, philosophy and cognitive psychology. It offers a framework for examining and strengthening the critical linkages among education, work and personal development [4]. Schön [6] has described experiential learning as a conception of reflection-in-action. These experiences extend competences required in their work (knowing-in-action).

In the education field, experiential learning methods are receiving more interest and attention. As Weathersby [7] points out, adults' learning interests are embedded in their personal histories, in their vision of who they are in the world and what they can do and want to do. So for adults, learning methods that combine work and study, theory and practice provide a more familiar and productive environment. Learning is experiential in the way that the learner is directly in touch with the realities being studied. It involves direct encounter with the phenomenon being studied rather than merely thinking about the encounter [8]. Experiential learning is attributed to the educational philosophy of Dewey [9]. He argues that there is an intimate and necessary relation between the processes of actual experience and education.

One tradition in experiential learning stems from the founder of American social psychology, Lewin [10]. In particular, his work in the field of group dynamics and the methodology of action research have had the most far-reaching practical significance. From these studies came the laboratory-training method. In all of his work, Lewin [10] was concerned about the integration of theory and practice. In one of his training programs the trainees were allowed to be involved in an analytical session with the research staff. This session

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